

Science, Technology and Innovation (STI) Indicators and R&D and Innovation Surveys in South Africa

National Science and Technology Forum

Plenary Meeting

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Human Sciences Research Council (HSRC)

Aim of the presentation

- To provide an overview of the Science, Technology and Innovation (STI) System in South Africa
- Mainly through data and indicators arising from the R&D and Innovation Surveys

Overview of Presentation

- Background
- R&D Surveys
- Innovation Surveys
- South African International Rankings and Conclusions

Background

- In 2002 the Centre for Science, Technology and Innovation Indicators (CeSTII) was established in the HSRC and commissioned by the Department of Science and Technology (DST) to conduct Annual R&D Surveys and regular Innovation Surveys
- The aim was to establish a baseline set of indicators for DST to monitor progress in achieving the National System of Innovation and R&D Strategy goals
- This aim has now been achieved and CeSTII is building up the series of data and indicators and progressing with more analytical work

Background

- CeSTII has now undertaken eight R&D Surveys since the first one for 2001/02 with a ninth one in the field for 2010/11
- We have also two innovation surveys (Innovation Surveys 2005 and 2008) with a third being planned
- Also Biotechnology and Agricultural R&D Surveys
- Produce national STI data and indicators
- Annual submissions of data to OECD and UNESCO
- Active in the African Science, Technology and Innovation Indicators (ASTII) Initiative

RESEARCH AND DEVELOPMENT (R&D) SURVEYS

Figure 3

Gross Expenditure on R&D as a percentage of GDP
2008* (*or latest year available)

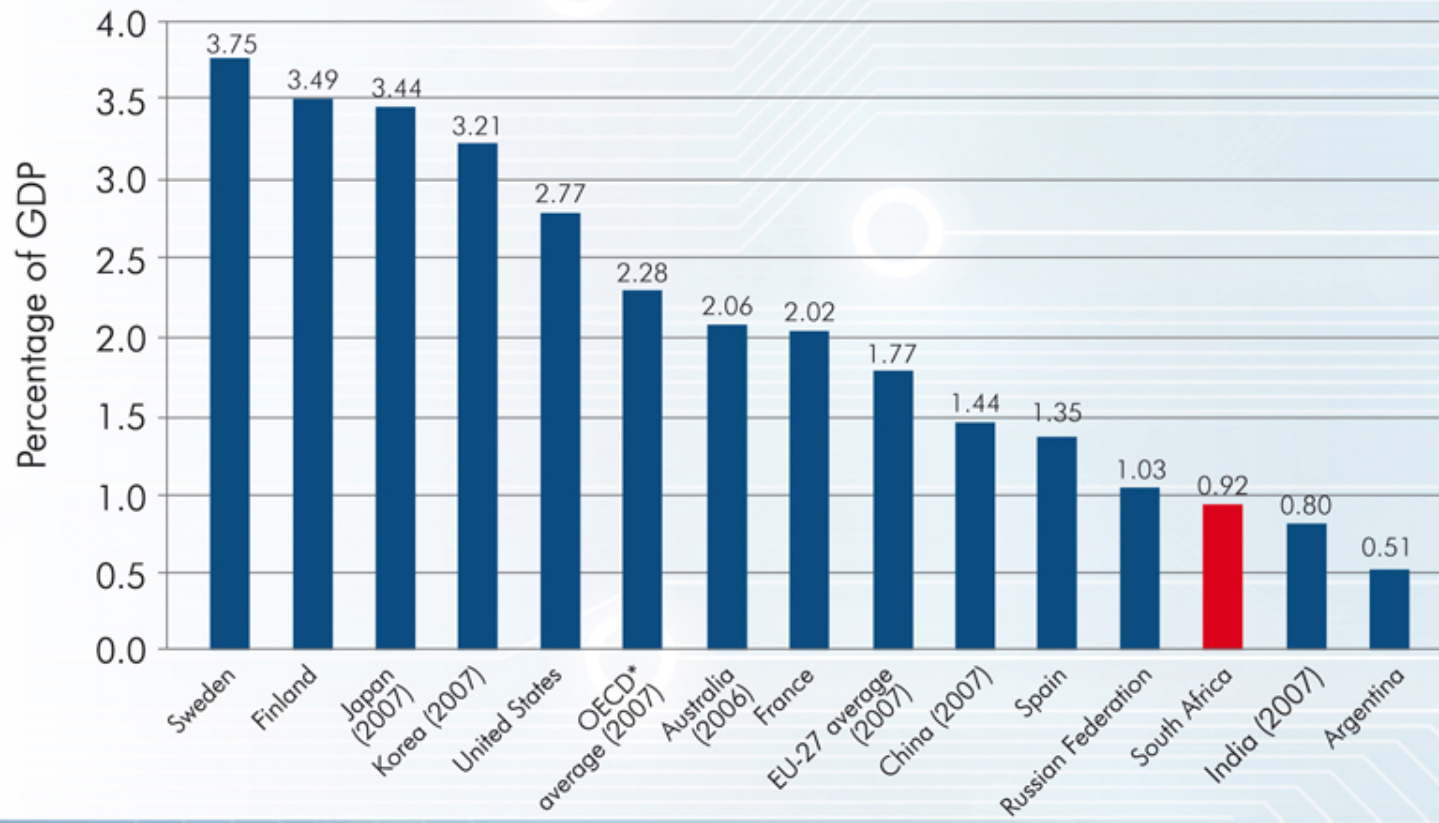
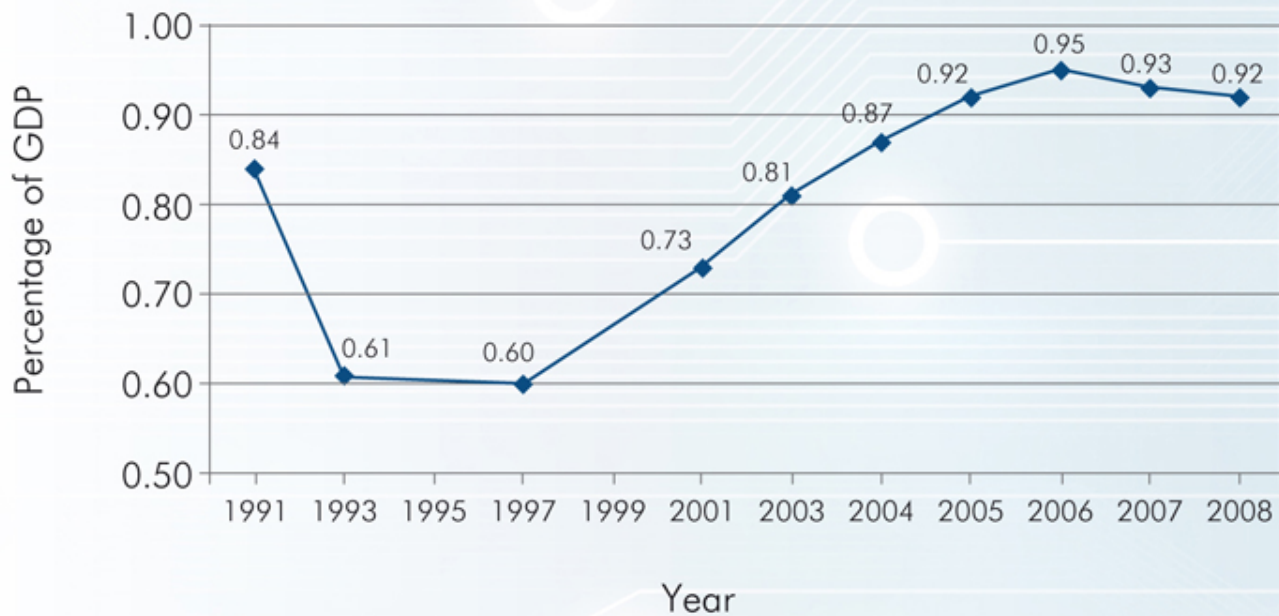
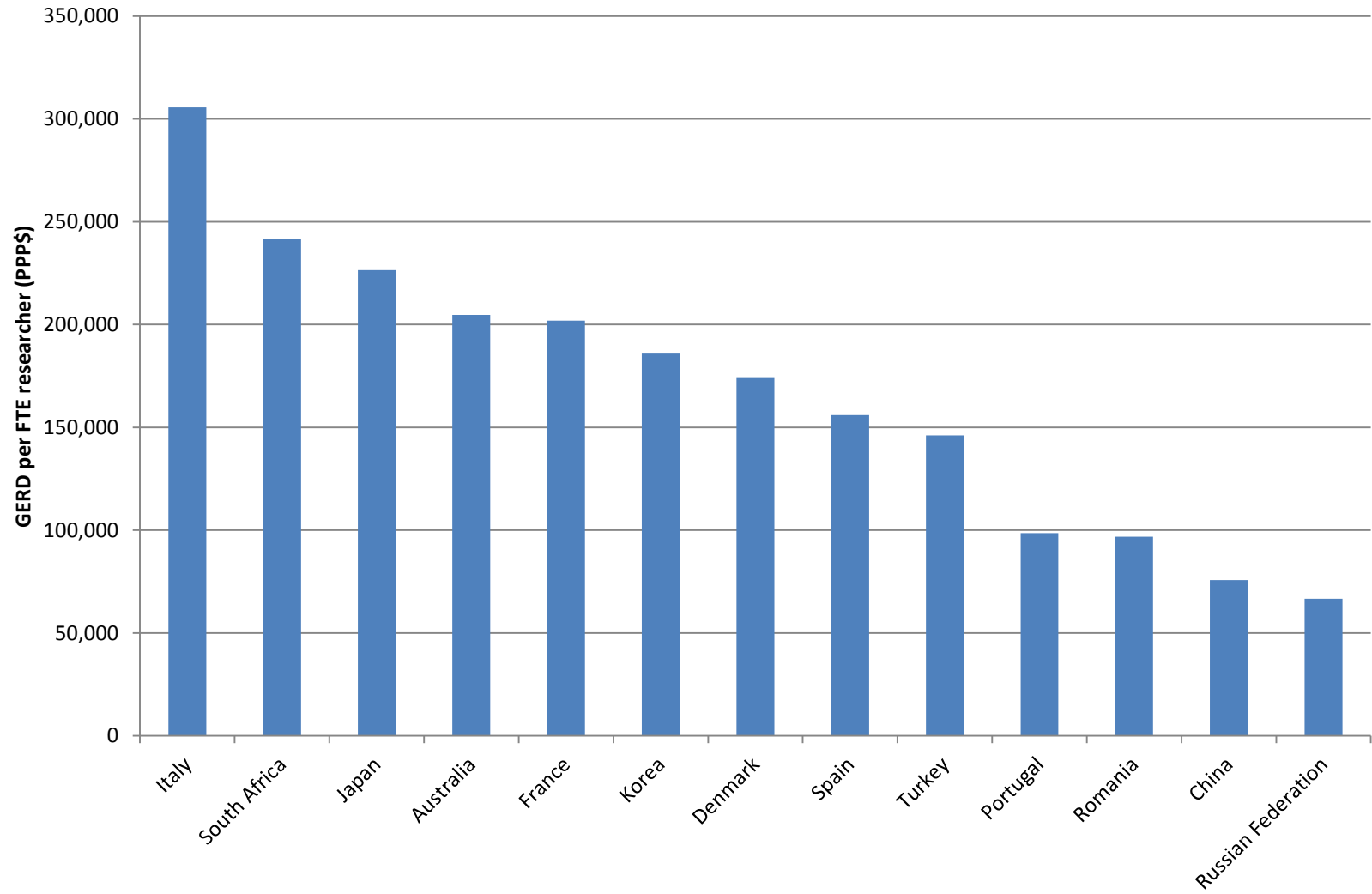


Figure 2

Gross Expenditure on R&D as a percentage of GDP
(South Africa, 1991-2008)



GERD per FTE researcher 2008 (PPP\$)



GERD per capita 2008 (PPP\$)

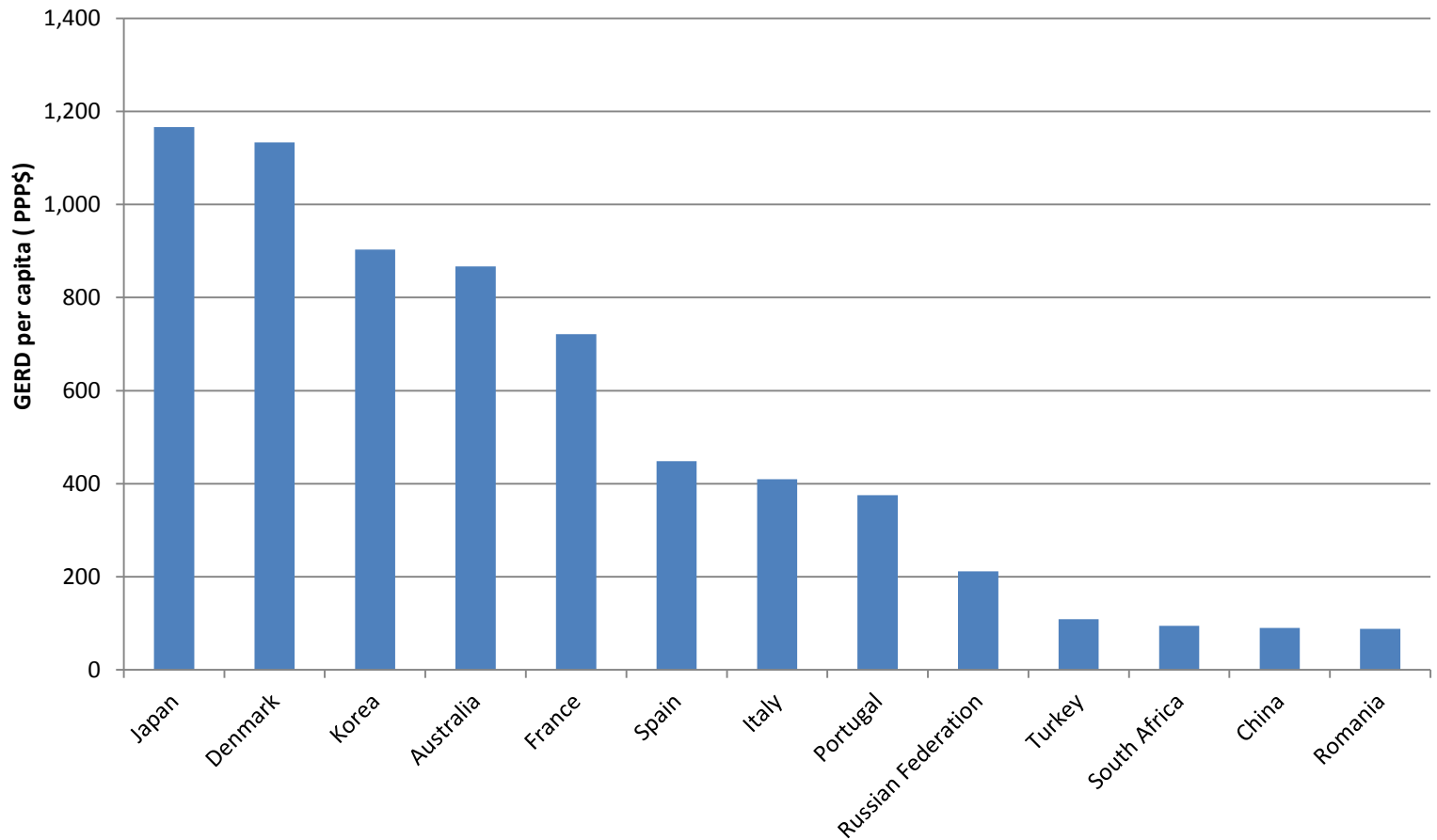
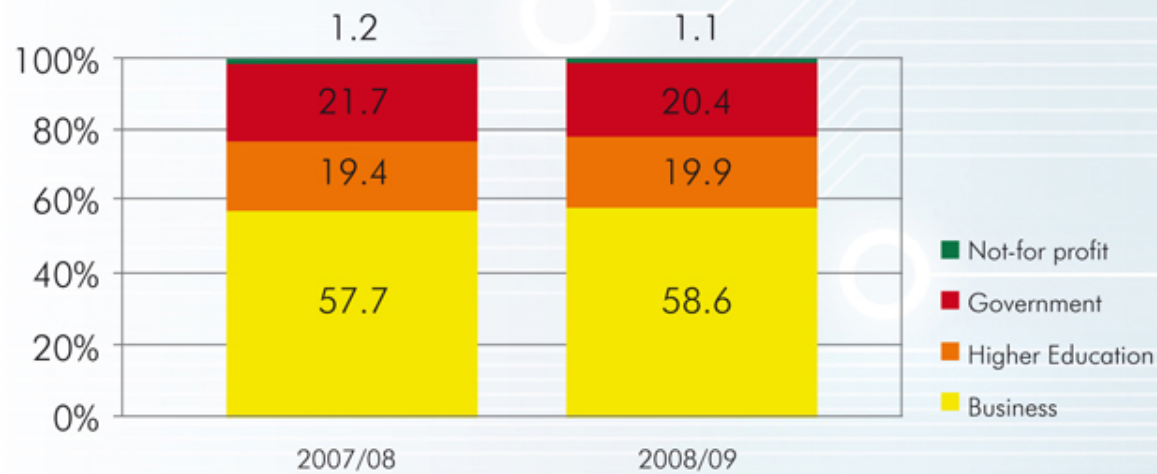


Figure 7

Performance of R&D by Sector
(South Africa, 2007/08 & 2008/09)



| Expenditure (R 000s) | Business | Higher Education | Government | Not-for Profit | Total |
|-------------------------|------------|---------------------|------------|----------------|------------|
| 2007 | 10,738,456 | 3,631,473 | 4,040,493 | 223,202 | 18,633,624 |
| 2008 | 12 332 012 | 4,191,366 | 4 277 019 | 240 649 | 21 041 046 |

Figure 4

Number of Full Time Equivalent (FTE) researchers per 1000 total employment in 2008*

*or latest year available

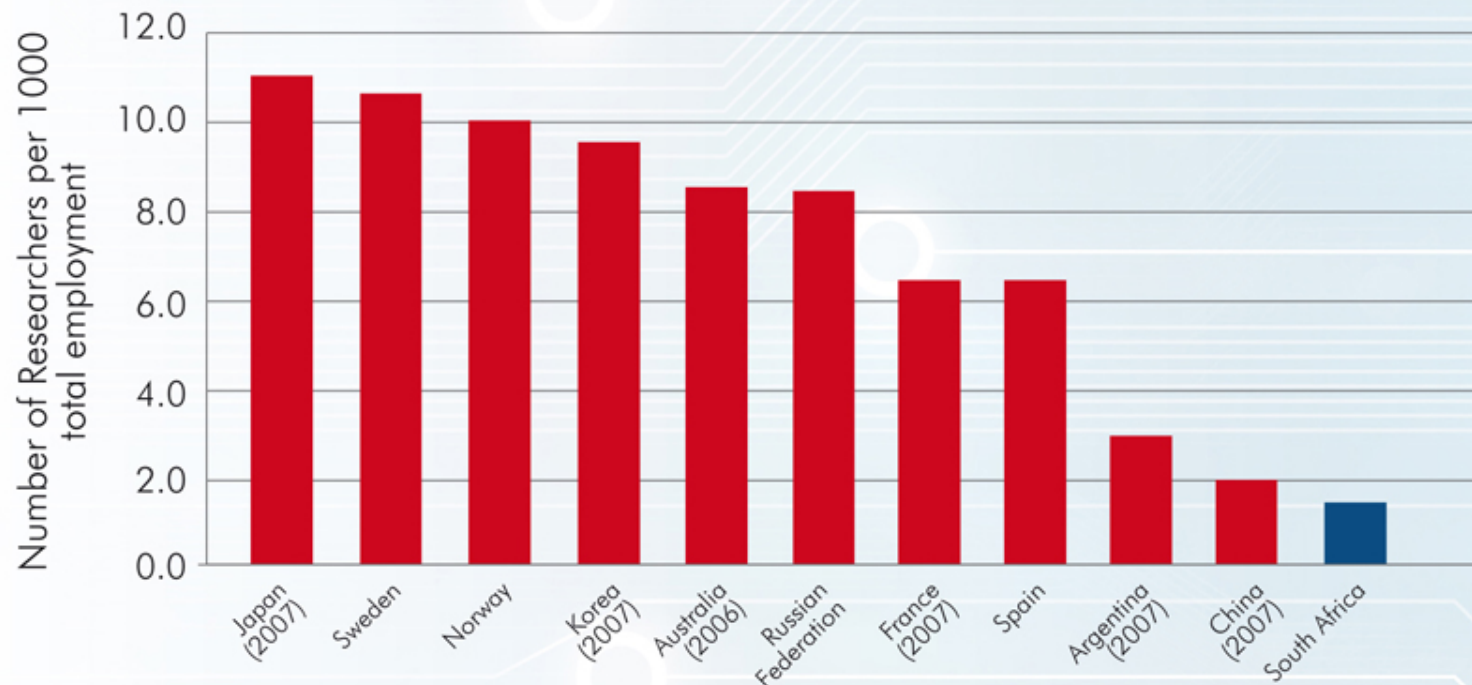
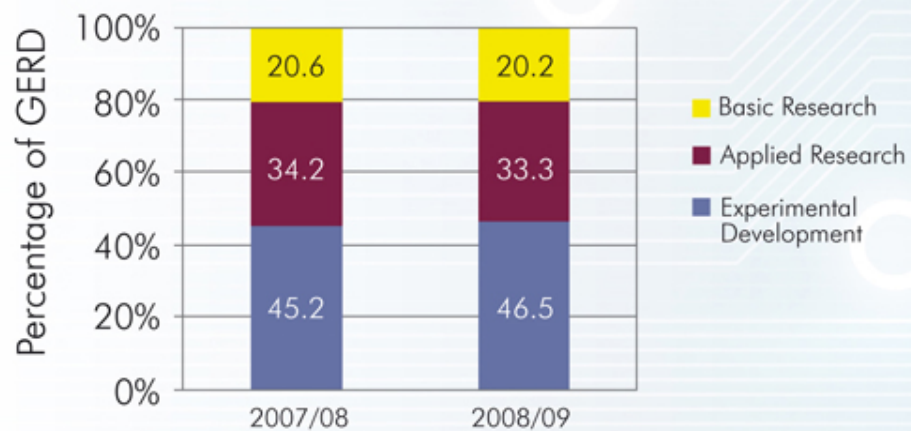


Figure 10

Gross Expenditure on R&D by type of R&D (South Africa, 2007 & 2008)



Figures above bars show R&D expenditure on basic research in million current PPP\$

Figure 11

Basic Research as a percentage of GDP 2008/09*

*or latest year available

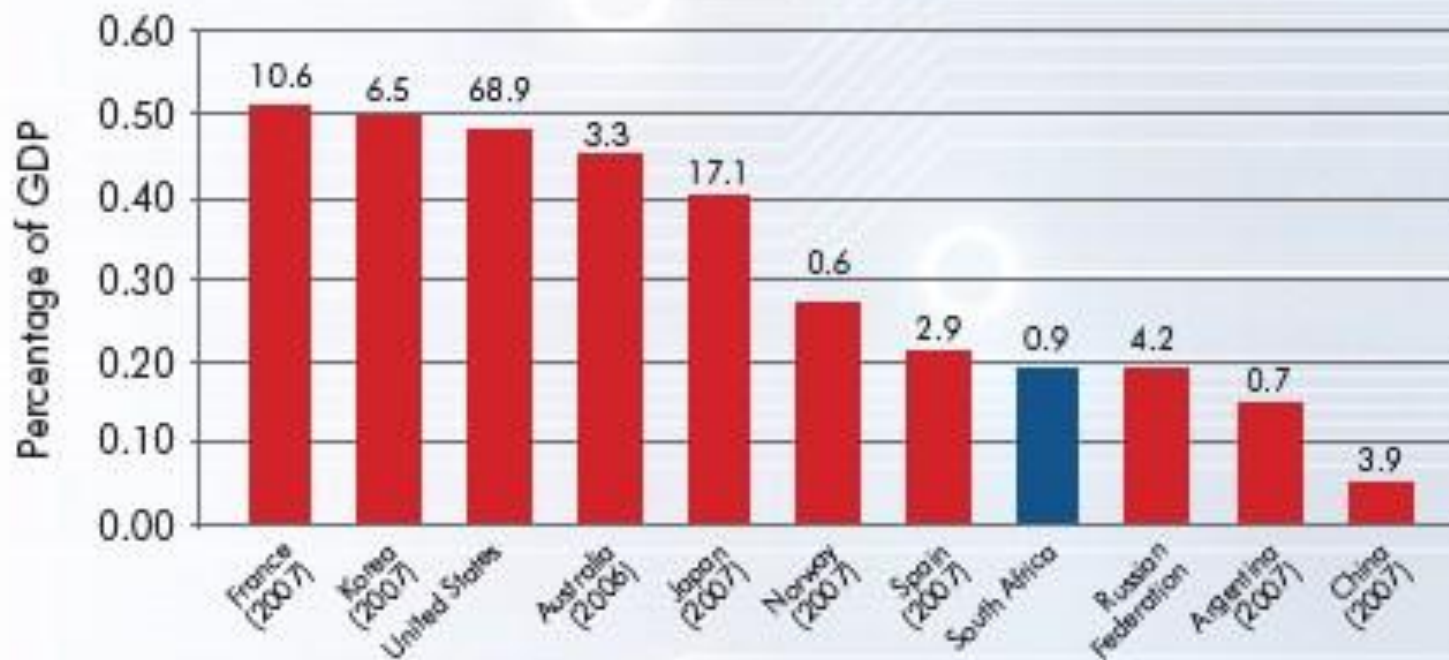
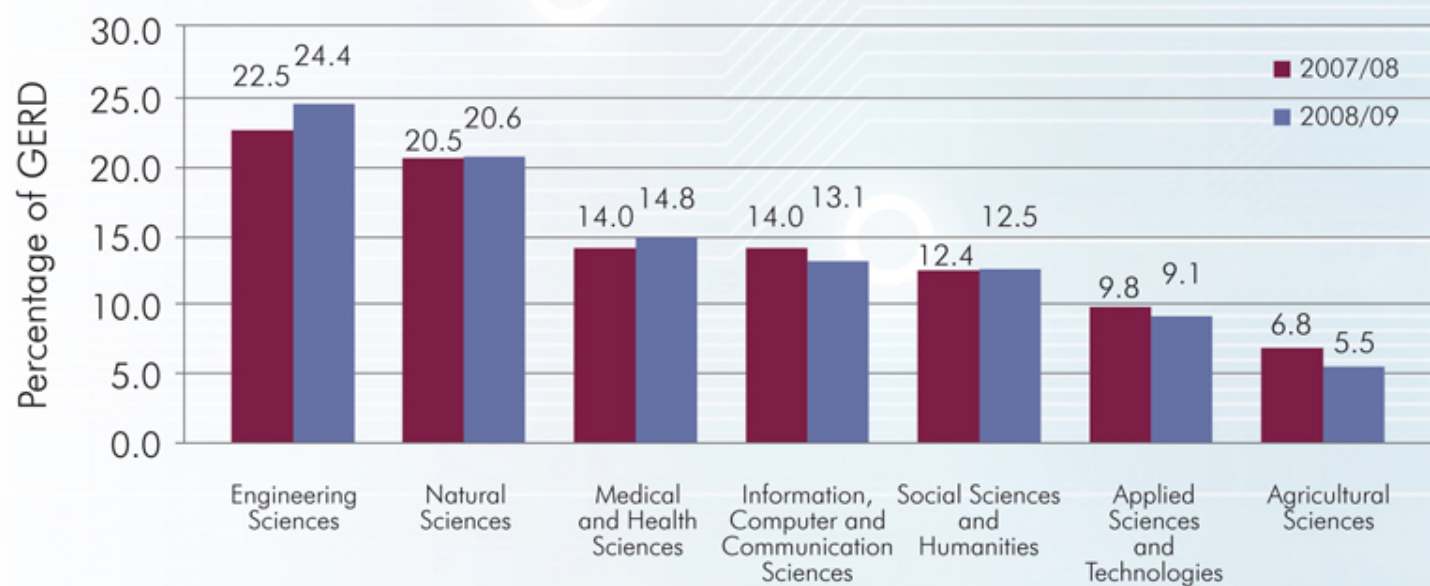
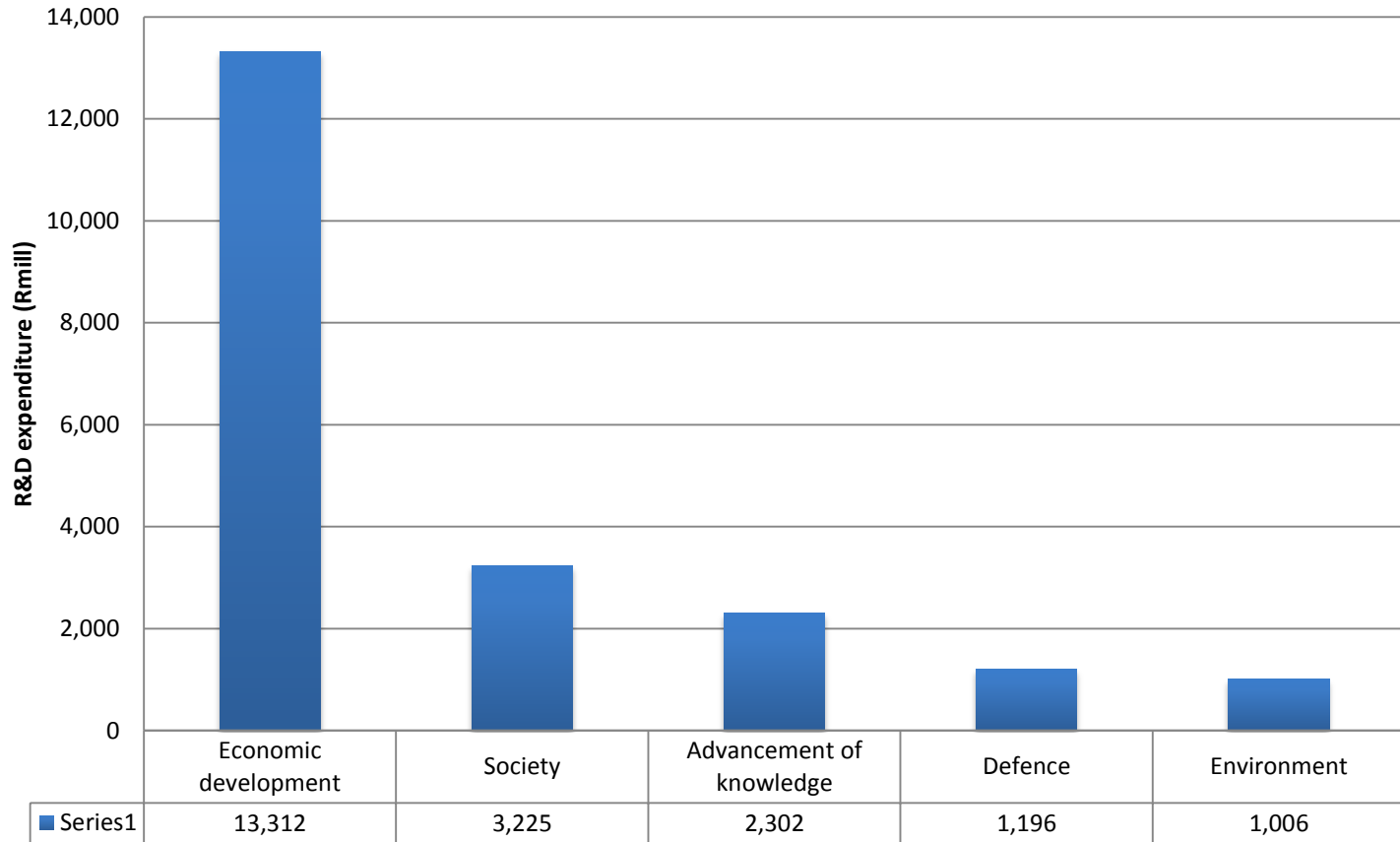


Figure 9

Expenditure on R&D by major research field (South Africa, 2007/08 & 2008/09)



**South African R&D expenditure by
socio-economic objectives (SEOs) 2008/09**
Total = R 21 041 million



South African R&D expenditure according to economic development objectives, 2008/09

Total = R13 312 million

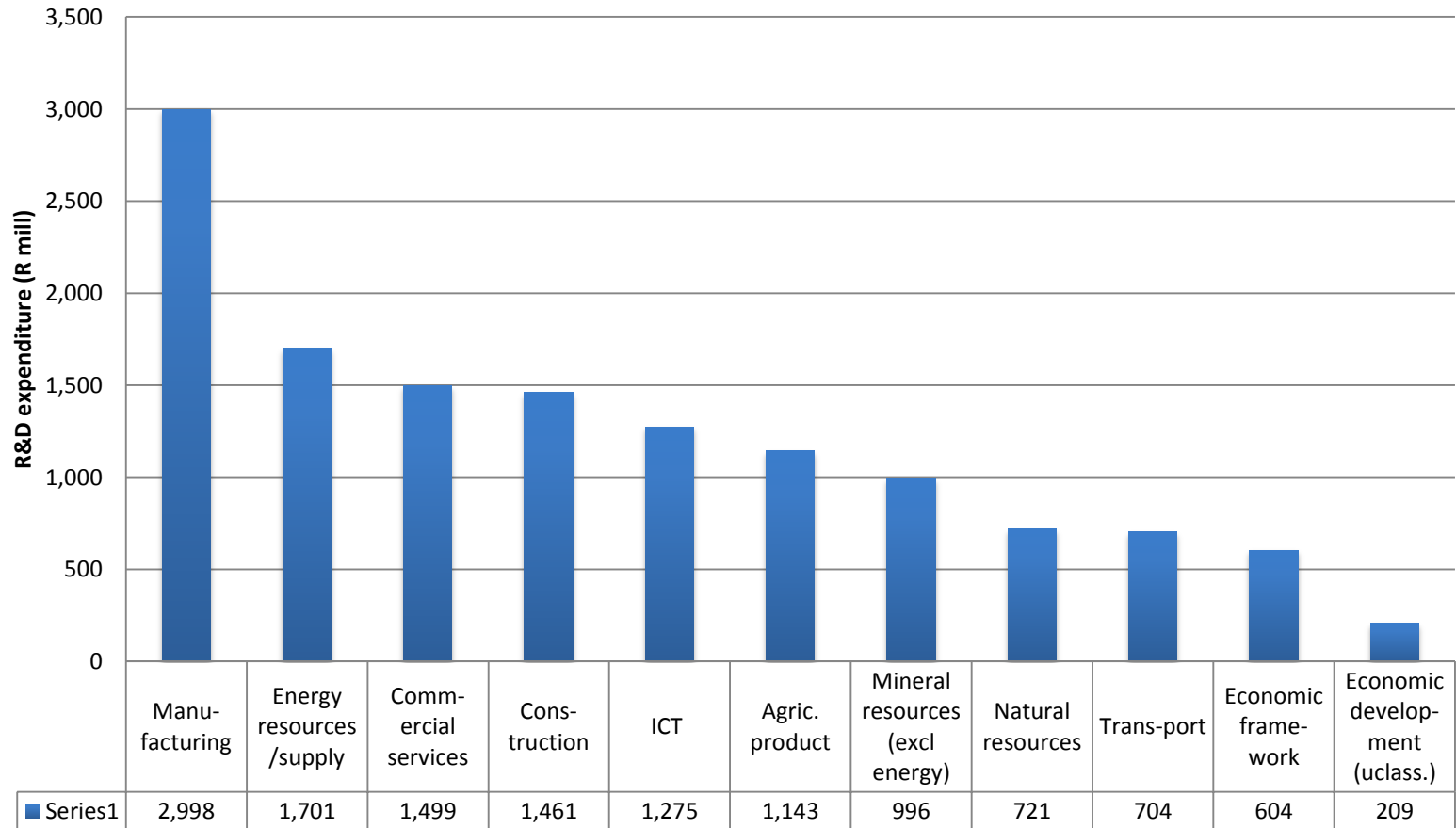
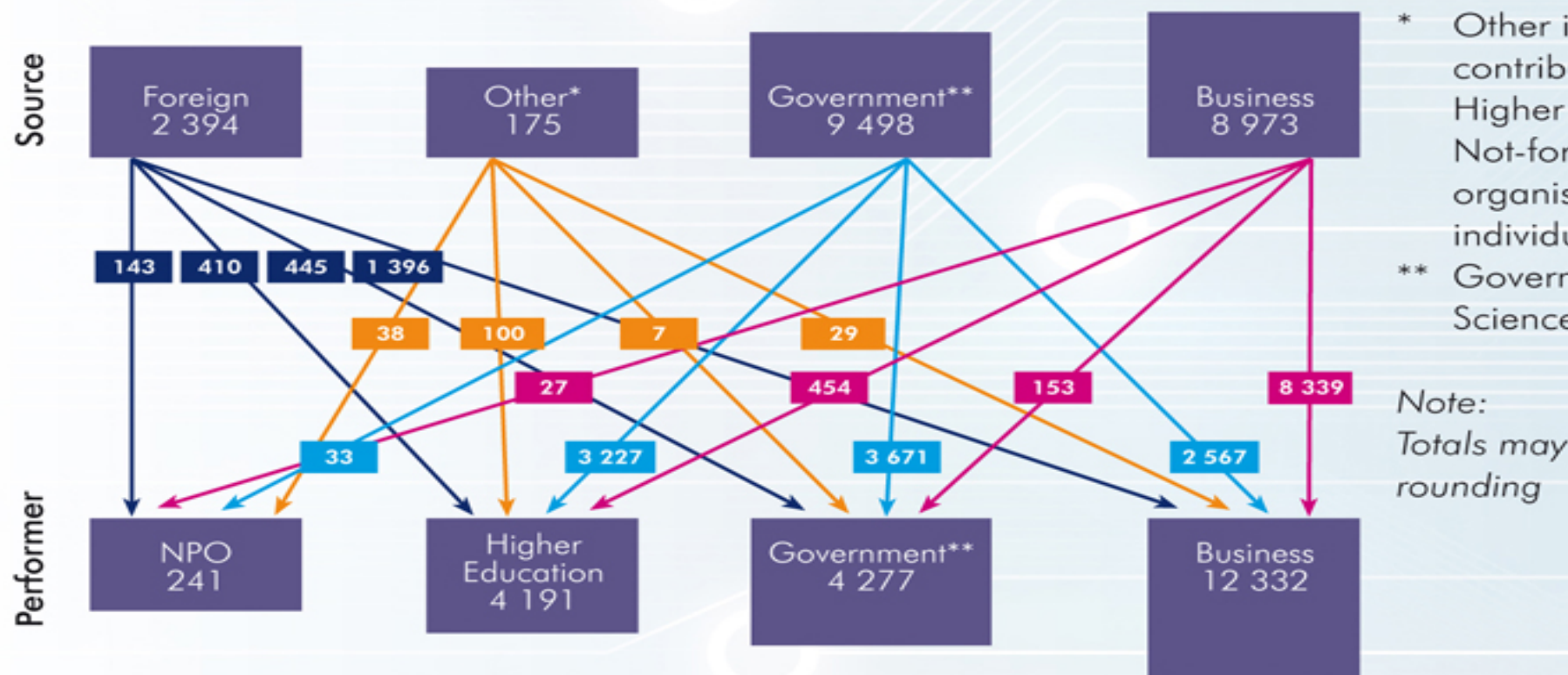


Figure 8

Major flows of funding for R&D, 2008/09 (R millions)



Financing mechanisms

- Encourage flow of foreign funds into South Africa

| Year | % of GERD from foreign sources |
|------|--------------------------------|
| 2003 | 10.9 |
| 2004 | 15.3 |
| 2005 | 13.6 |
| 2006 | 10.6 |
| 2007 | 10.7 |
| 2008 | 11.4 |

- Government aims to increase this flow to 15% by 2018

International S&T partnerships

- South Africa has a plentiful and rich variety of bilateral, multilateral and regional partnerships and networks around S&T, R&D and innovation – both formal and informal
 - Diplomatic relations with countries and organisations through 124 missions in 107 countries
 - Participates in global challenges such the global millennium project and global scientific projects

Number of Business Sector R&D Collaborative Projects 2008/09

N = 762 R&D performing business enterprises

| Partner | South African | International |
|--|---------------|---------------|
| Other companies (including specialist consultants) | 170 | 59 |
| Higher education institutions | 139 | 12 |
| Members of own or affiliated company | 79 | 26 |
| Government research institutes | 32 | 5 |
| Science councils | 21 | 1 |
| Not-for-profits | 16 | 6 |
| Total | 457 | 109 |

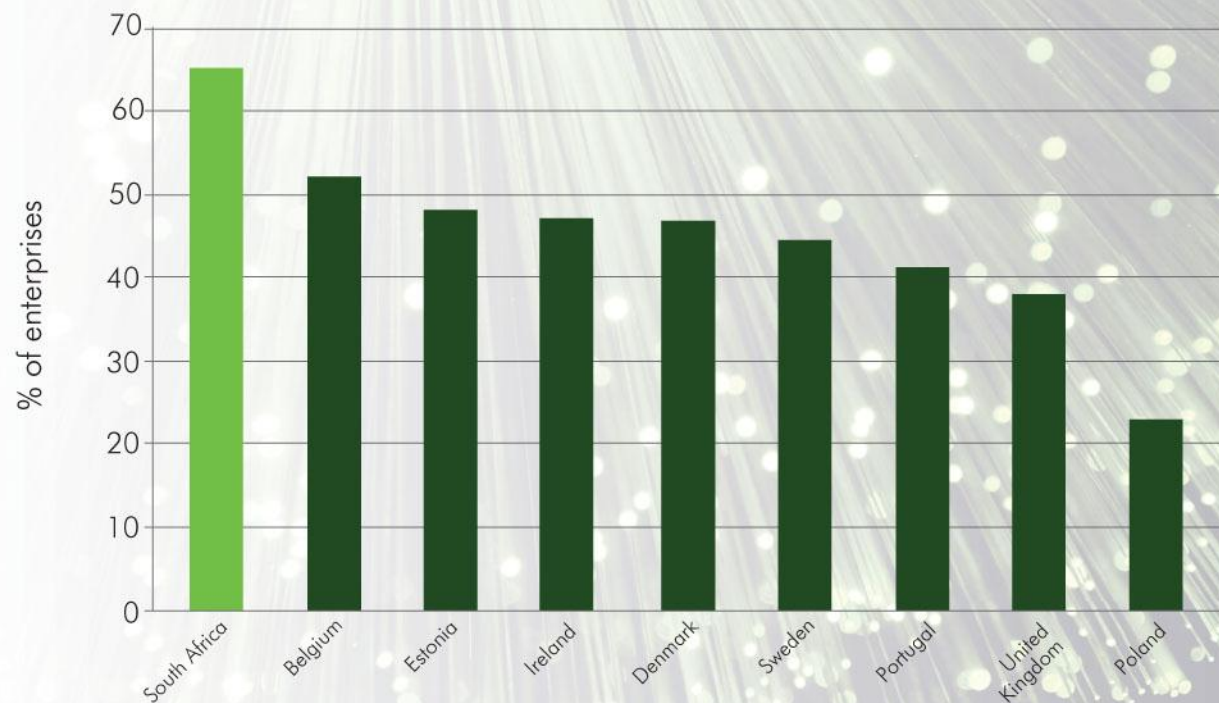
R&D in Multidisciplinary Areas

- In 2008/09 South African expenditure on R&D in **Biotechnology** was R801.6 million
- Higher education 38%; business 33%; science councils and government 29%
- In 2008/09 South African expenditure on R&D in **Nanotechnology** was R388.4 million
- Science councils and government 46%; higher education 39%; business 15%;

INNOVATION SURVEYS

Figure 2

South African share of enterprises with innovation activities compared to selected EU-countries (%), 2005 – 2007



* EU-countries data are for the time period 2004 - 2006

Figure 1

Innovation rate by type of innovation, 2005 - 2007

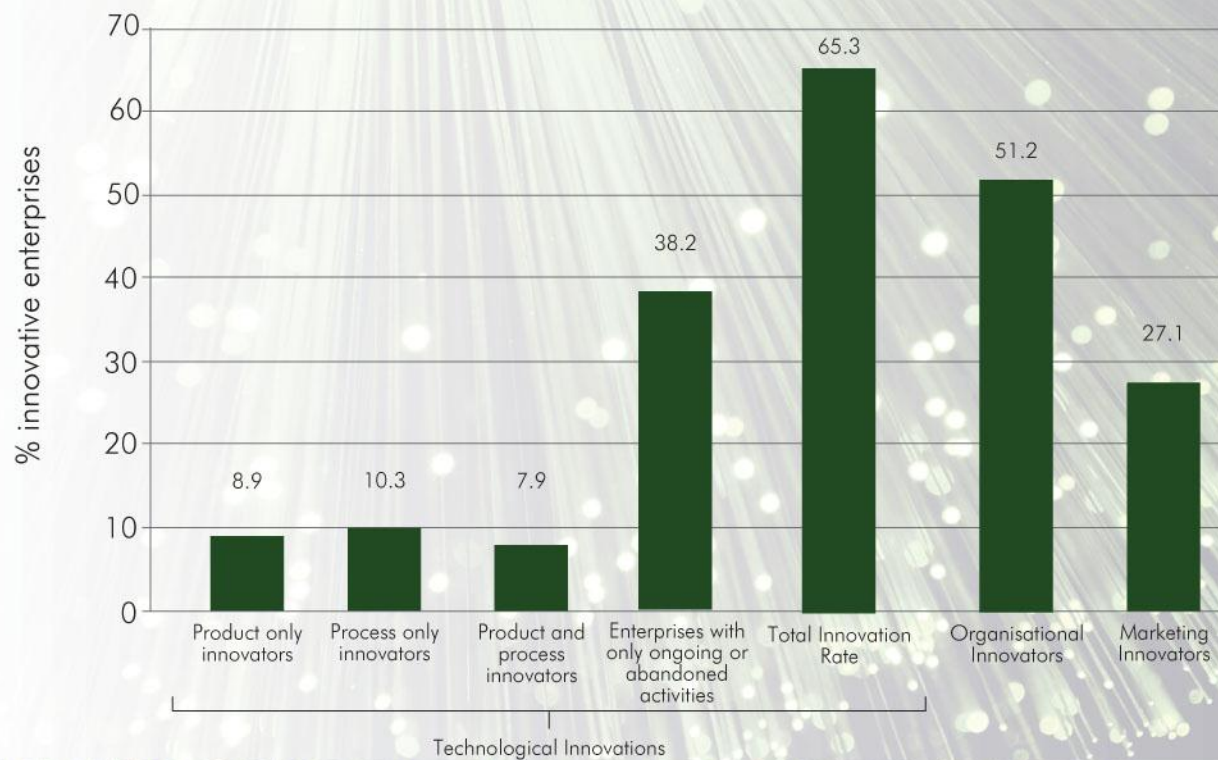
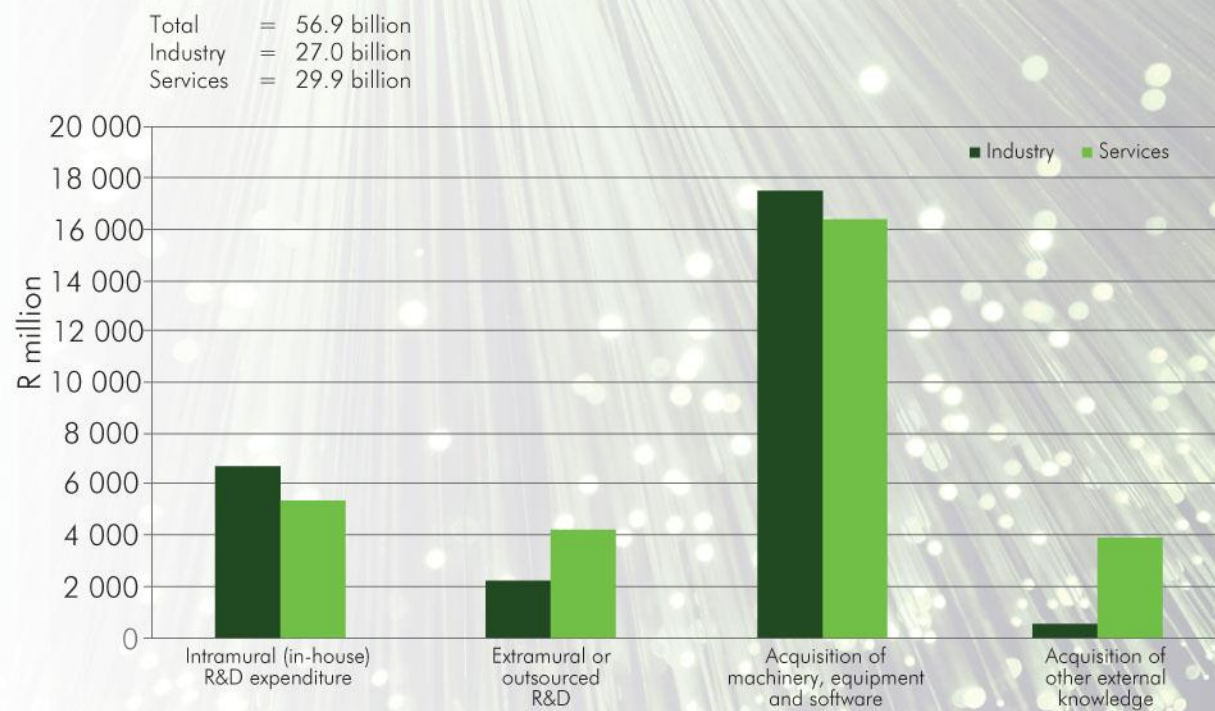


Figure 3

Expenditure (in million rands) of enterprises on innovation activities, 2007



Turnover generated by 'new to market' and 'new to firm' products = R370 billion

Product (goods and services) innovators - breakdown of turnover (in billion rands) by product type, 2007

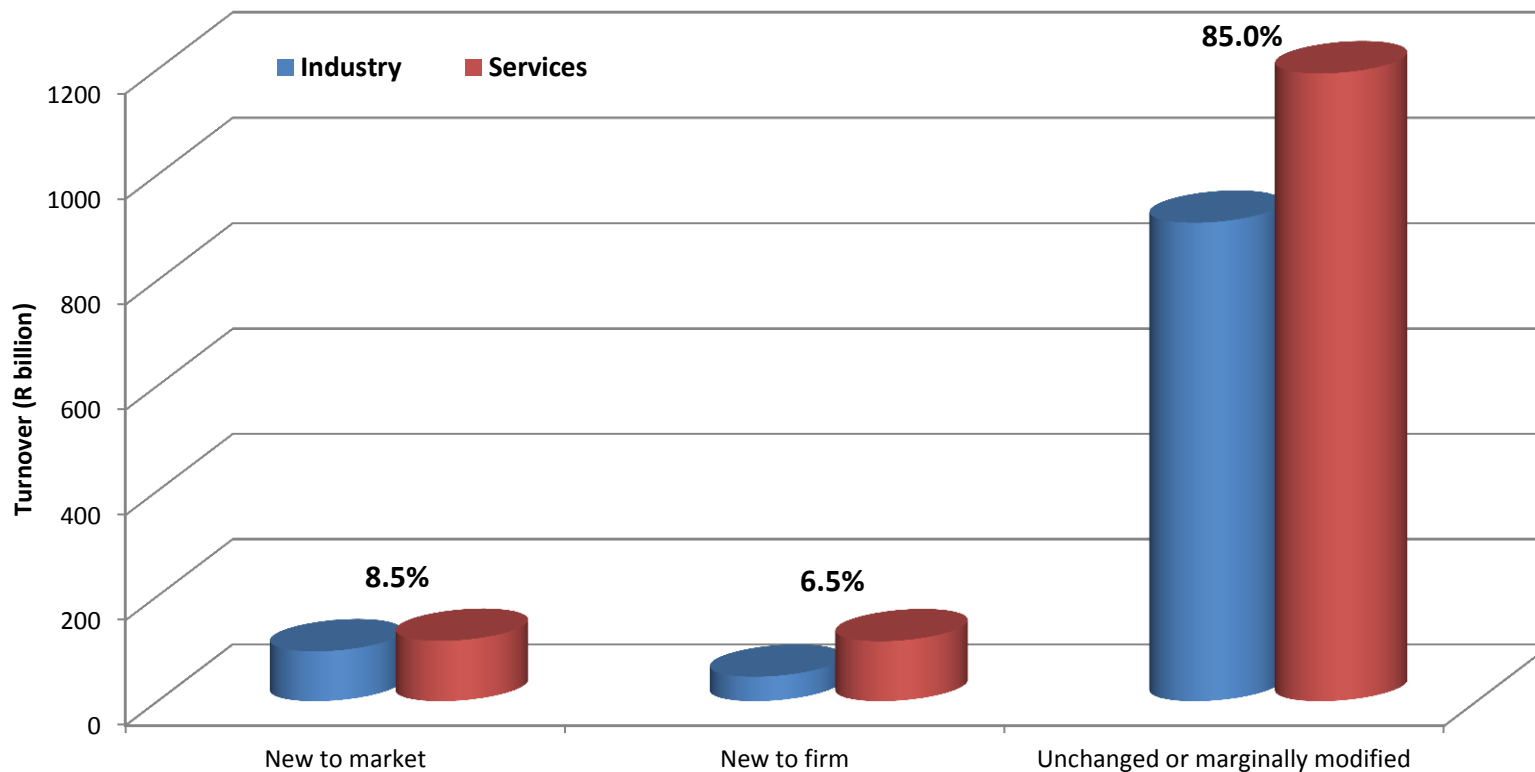


Figure 7

Sources of information rated as “highly important” by innovative enterprises, 2005 – 2007

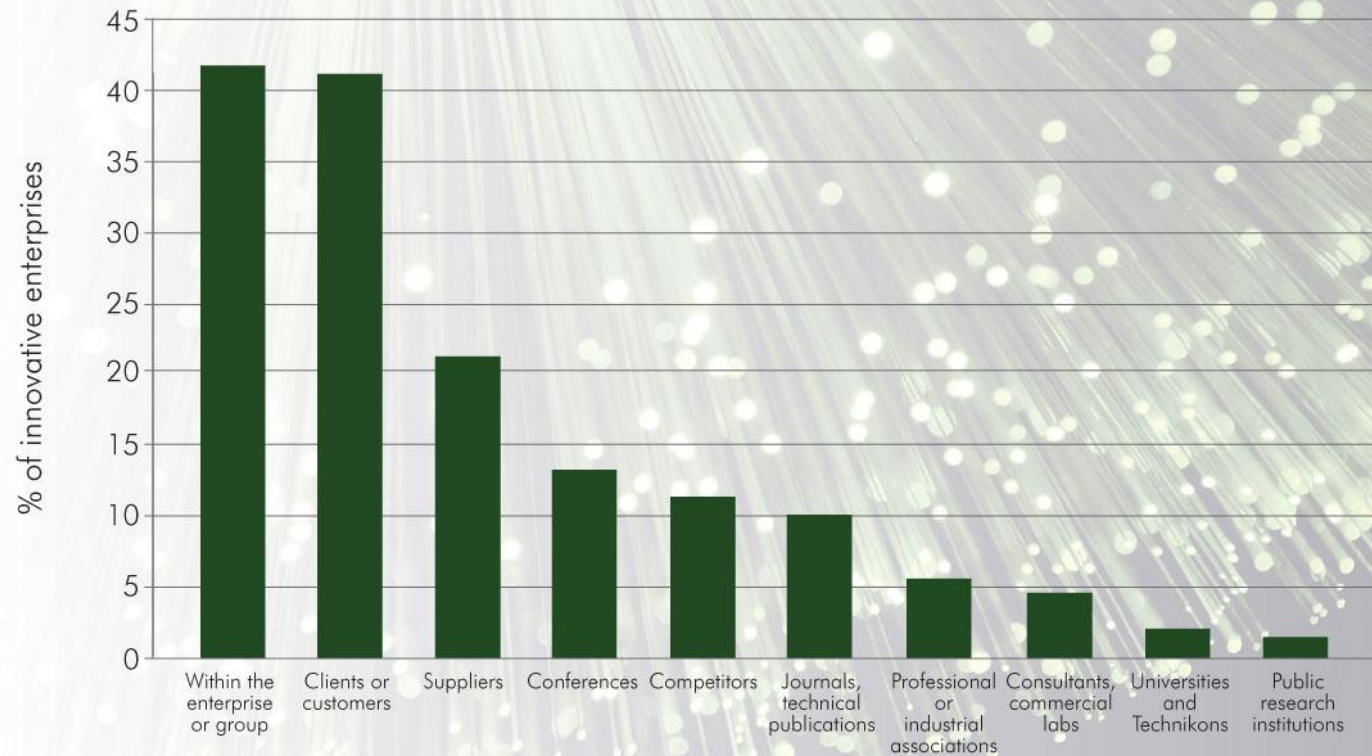
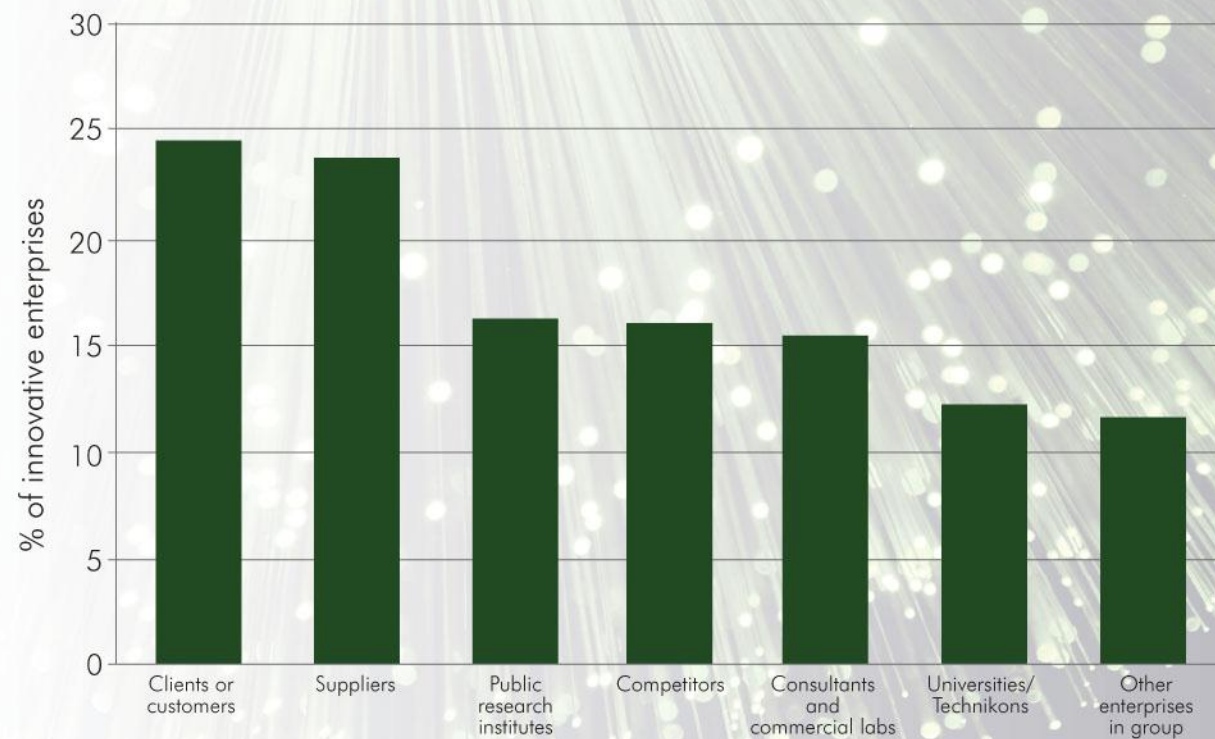


Figure 11

Collaborative partnerships for innovation activities by type of partner, 2005 – 2007



Number of South African collaborative partnerships for innovation by region and type of partner 2005-2007

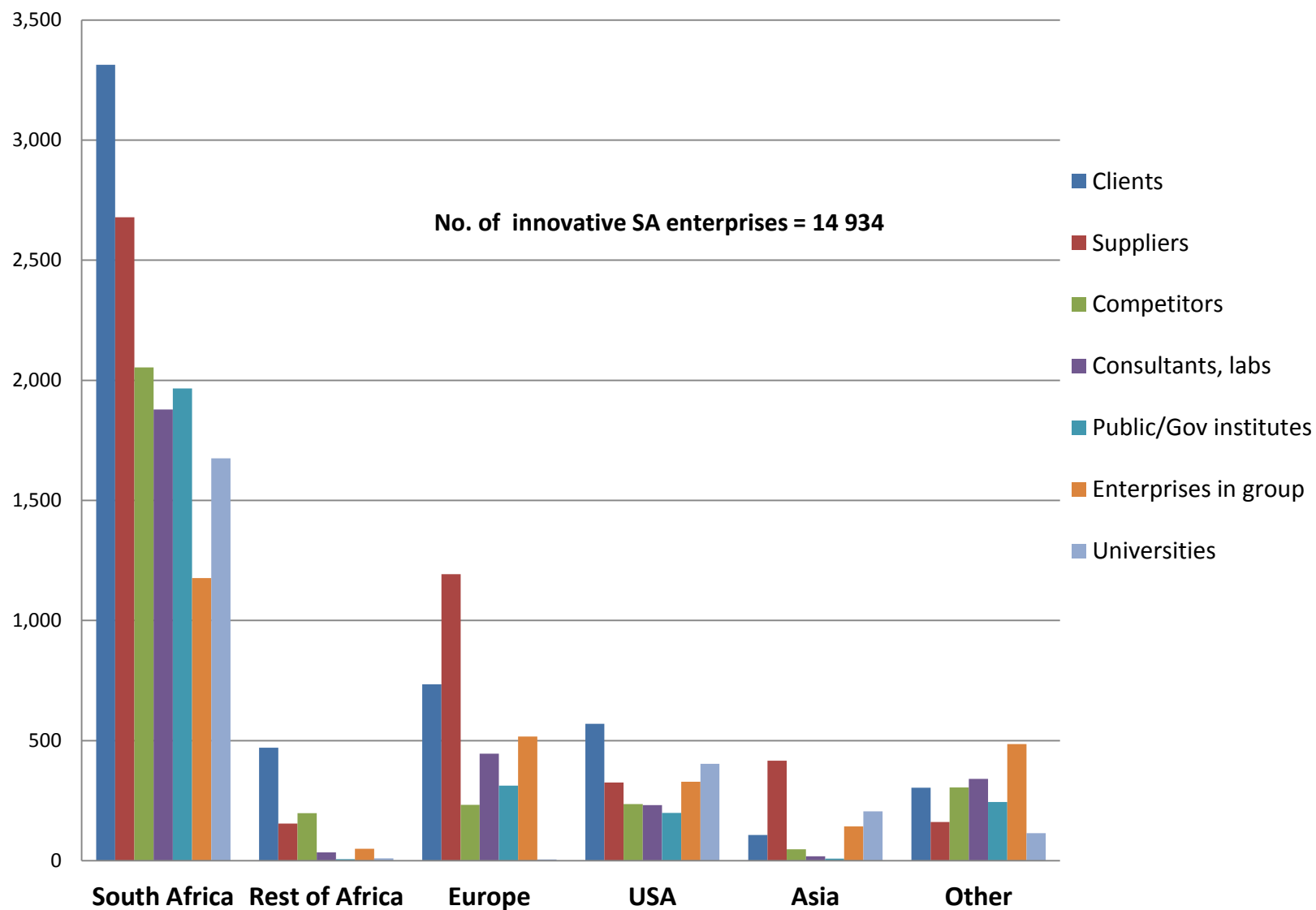


Figure 5

Innovative enterprises (%) – responsibility for the development of product innovations, 2005 – 2007

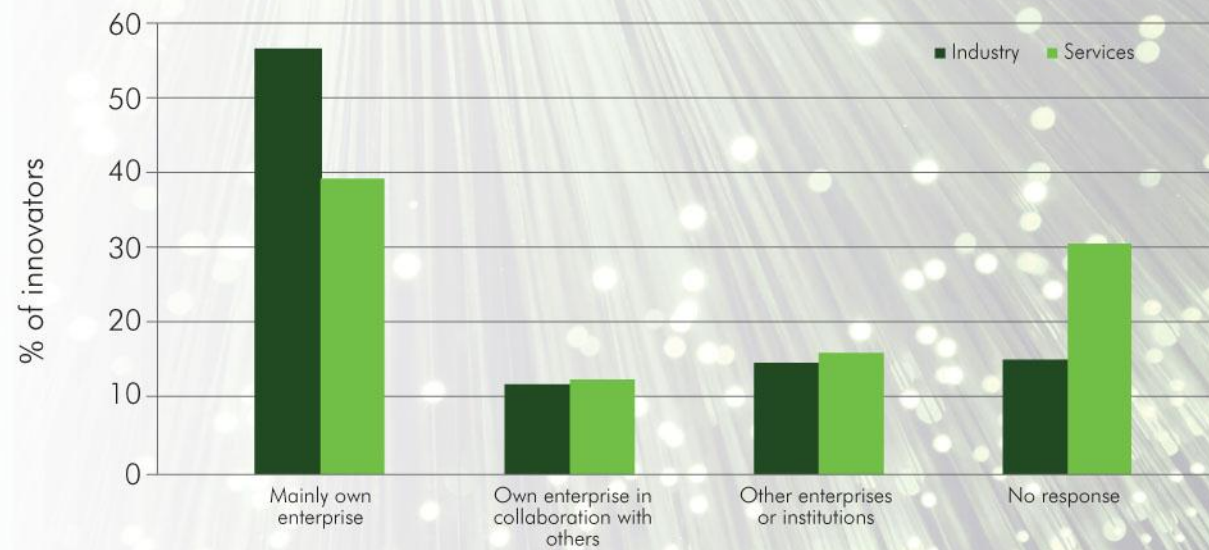


Figure 12

Geographic distribution of goods and services sold by innovative and non-innovative enterprises, 2005 – 2007

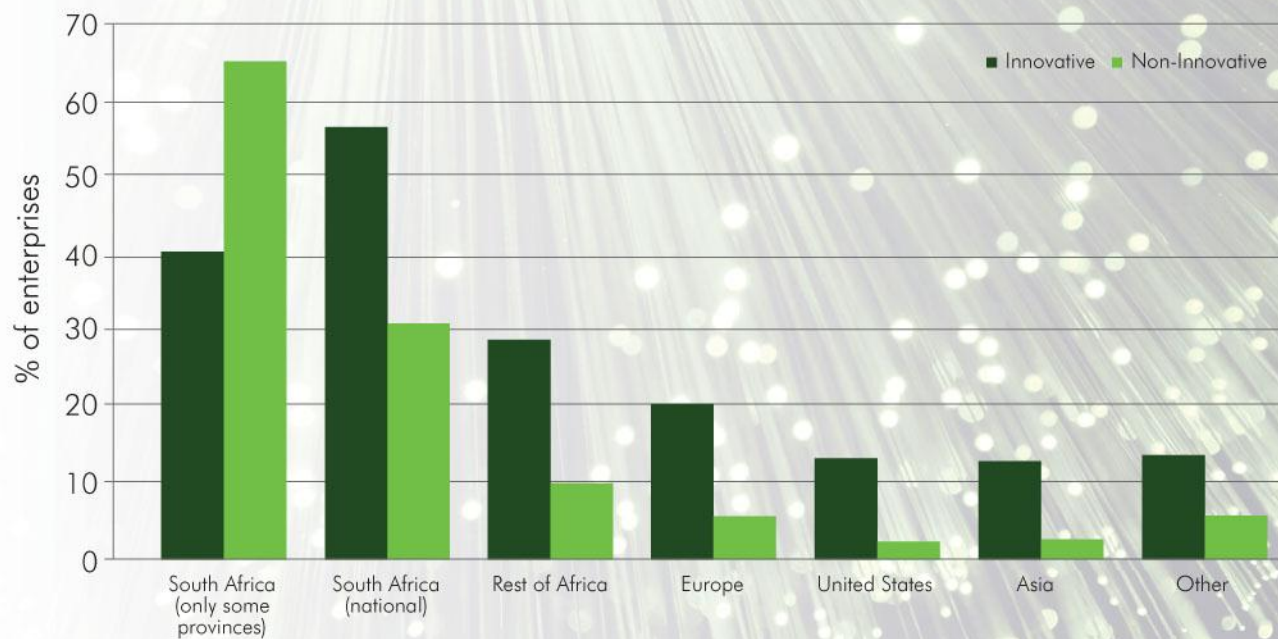
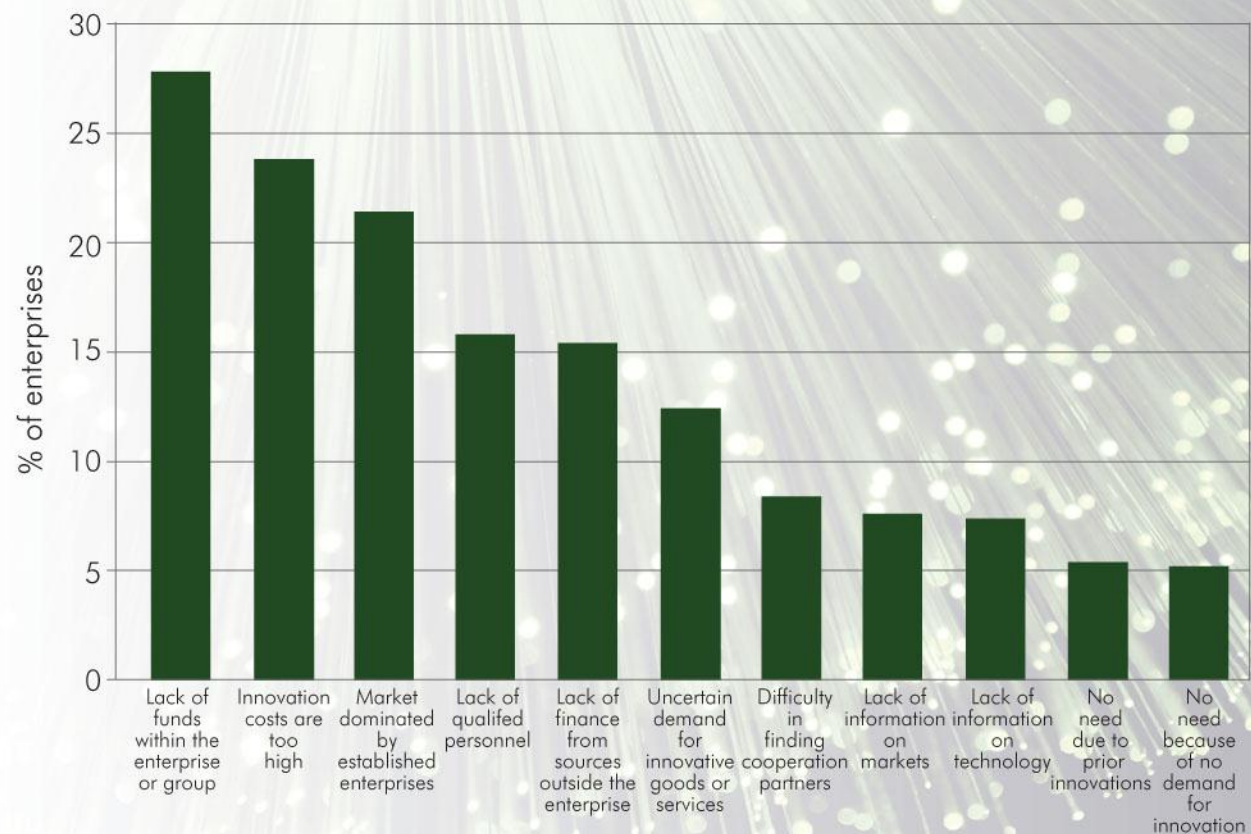


Figure 8

"Highly important" factors that hampered innovation activities, 2005 – 2007



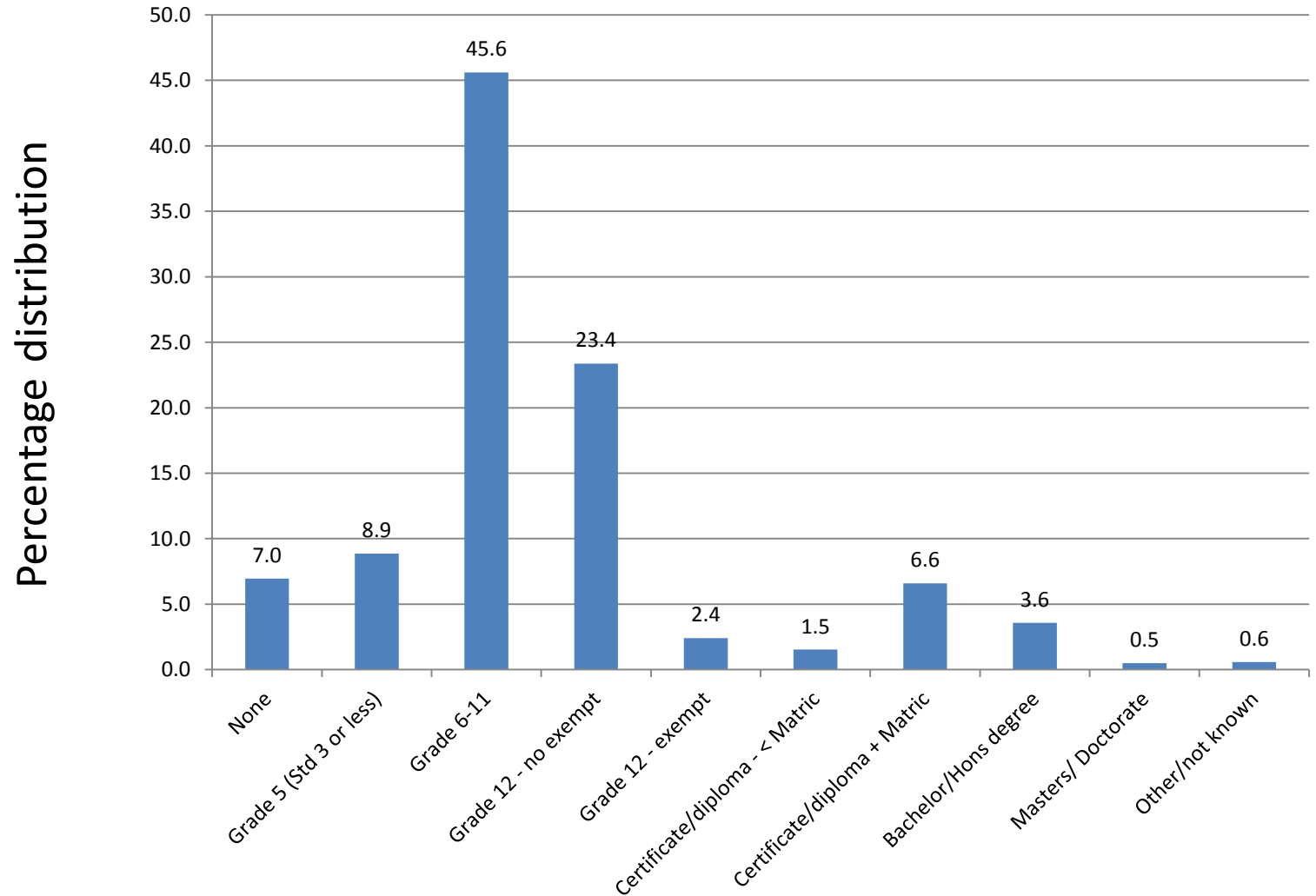
SOUTH AFRICAN INTERNATIONAL RANKINGS AND CONCLUSIONS

South African population aged 20+ by highest level of education, 2010

Total number of people with Matric plus certificate, diploma or degree = 3.1 million,
with degree = 1.2 million

Total employment = 13.0 million

Source: StatsSA General Household Survey 2010



| INDICATOR (from OECD STI Outlook 2010 and OECD MSTI 2011-1) (for 2008 or latest year available) | | | | |
|--|---------------------------|--------------------------------------|----------------------------|-------------------------------|
| | RSA Rank | Number of countries | RSA Score | OECD Average |
| Government financed R&D in business | 2 | 38 | 20.8 | 6.5 |
| GERD financed by government | 8 | 40 | 45.1 | 27.8 |
| Research performed in government research institutes | 23 | 38 | 0.19 | 0.26 |
| BERD by intensity | 29 | 38 | 0.54 | 1.63 |
| GERD as % GDP (2008 or latest year) | 31 | 38 | 0.93 | 2.33 |
| HERD as % GDP | 31 | 38 | 0.18 | 0.4 |

| INDICATOR | RSA Rank | Number of countries | RSA Score | OECD Average |
|---|-----------------|----------------------------|------------------|---------------------|
| S&E degrees as % of new degrees | 31 | 37 | 16.4 | n/a |
| Triadic patent families per million population (approx.) | 33 | 42 | 0.6 | 38 |
| GERD financed by business | 33 | 40 | 42.6 | 64.4 |
| Country share in total world scientific articles | 34 | 43 | 0.3 | 2.1 |
| BERD funding by government | 36 | 40 | 20.8 | 6.5 |
| Scientific articles per million population 2008 (approx.) | 41 | 43 | 175 | 790 |

Financing

- At present GERD shows real increases from year to year but is not keeping pace with growth of GDP
- Government is motivated to increase funding but competition for public resources (housing/health etc) is strong

Financing

- Business sector historically strong in R&D and innovation expenditure but needs encouragement and policy stability to expand its investments in R&D and innovation
- Government needs to be more innovative with existing funds – create mechanisms and incentives that encourage innovation in both the private and public sectors
- Not just a matter of increasing the quantum of R&D expenditure

Shortage of researchers

- South Africa has one of the highest ratios of GERD per FTE researcher and one of the lowest ratios of GERD per capita
 - R&D funding generally sufficient but a critical shortage of researchers and other high level skills to address research and innovation problems
 - This is South Africa's own “wicked problem” how to significantly increase the number of researchers in the system
 - No easy solution in the medium term

Conclusions

- South Africa has a wide range of R&D and innovation investments and activities that collectively can address many of the global and social challenges facing the country
- The country has a rich array of regional and international partnerships that can help it address areas where capacity is lacking

Conclusions

- A long term commitment to encouraging, funding, supporting and growing R&D and innovation in all sectors will be vital if South Africa wants to address economic and social challenges
- An immediate and urgent problem to address is the chronic shortage of the highly skilled, particularly researchers and technologists, but this will remain a long term hurdle unless fundamental remedies are agreed upon and implemented in the medium term